

18 January 1965

*JWC*

MEMORANDUM FOR: The Record

SUBJECT: January 13 Meeting on Short-Term Study of Stereo  
Convergence and Obliquity: [redacted]

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1. It was agreed that the short-term study would make use of  
[redacted] aerial model for simulating the following conditions:

a. Stereo Angles -  $10^{\circ}$ ,  $20^{\circ}$ ,  $30^{\circ}$   
At NADIR and in combination with the  
following angles of obliquity:

b. Obliquity Angles -  $0^{\circ}$ ,  $10^{\circ}$ ,  $20^{\circ}$ ,  $30^{\circ}$ ,  $45^{\circ}$ ,  $60^{\circ}$

Resulting in 18 pairs of photographs to be compared.

c. It should be noted that obliquity angles of  $0^{\circ}$ ,  $10^{\circ}$   
and  $20^{\circ}$  were added to [redacted] original figures when  
[redacted] pointed out that testing for convergence angles  
should include the effect at the NADIR and at minor angles of  
obliquity. As I recall, the original numbers were chosen in  
relation to: (1) another scheme of testing, and (2) an actual  
photo collection program which was to be specially flown.

d. [redacted] was to call [redacted] to specify our  
requirements and to request him to, in turn, inform us of what  
is actually possible with their model/set-up. All factors  
(such as film resolution) are to simulate as closely as possible  
[redacted] new system. Factors such as haze, sun angle and  
orientation are to be realistic in terms of Soviet Bloc coverage.

e. Details on processing, objects to be added to the model,  
time element involved in making the photographs, etc., are to be  
ironed out by Betty: and a trip is planned for the week of  
18 January for [redacted]  
facilities to make final arrangements.

f. The experimental design is to be based on a pair to  
pair comparison of photographs representing various convergences

NGA review(s)  
completed.

SUBJECT: January 13 Meeting on Short-Term Study of Stereo Convergence  
and Obliquity:

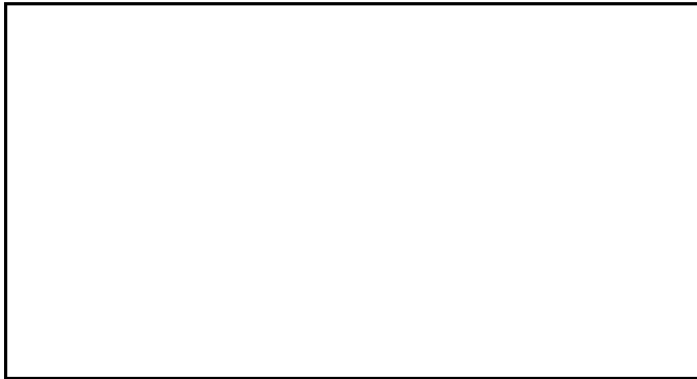
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and/or obliquities. Variables were, of course, discussed in greater detail, and the most important concerns will be accounted for in the tests and their resulting data.

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MEETING ON P.I. PERFORMANCE STUDIES 9 JANUARY 1965

25X1 ATTENDED BY:



25X1 [ ] proposed to discuss: (1) the short-term study on stereo and obliquity; (2) the long-range, two-year study; and (3) contractual help for the materials collection phase of the studies.

25X1 I. [ ] began to discuss the problem of how DIA's interests, as  
25X1 represented by [ ] could be considered in our present efforts. He was interrupted by [ ] who reviewed DIA's tactical requirements which are based on  $\frac{1}{2}$ " resolution for detailed analysis of, for example, dipoles on radar antennae.

1. Discussion: It was suggested that <sup>the</sup> same methods we are currently using in our studies perhaps are not suitable for answering DIA's questions, <sup>particularly since the questions</sup> are not the same kind as ours: we are interested in evaluating performance with satellite materials as opposed to low altitude tactical coverage.

2. Not an interpretation problem but a measurement problem.

3. Does photographic means lend itself to this problem? --That is the question that must first be answered.

II. Short-Term Study

1. For a given stereo angle with increasing obliquities: How far

SUBJECT: Meeting on P.I. Performance Studies

can we scan in terms of obliquity angle and still get stereo?

2. At NADIR: Ability to extract stereo information with  
varying degrees of stereo.

3. Goal of measuring heights and lengths.

4. Sun angle cannot be a constant

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5. Preference Test: Pair to Pair comparison-- for detailed  
intelligence and search situation.

a. Inter-judge agreement and replication is validity.

b. "Ordering" will depend on questions and target-type.

6. Useful questions in March time-scale:

a. Convergence pairs, same subject.

b. Threshold of new equipment

c. Value of stereo convergence never to be viewed in stereo.

d. Elements of Size:

1. Use data to account for things around object.

2. Answer depends upon detail-A size problem.

7. Suggestions for treatment of raw data: Hypothesize from data;  
general conclusions.

### III. General

1. Useful Data--indicates error limits

--proportion on ordinate

2. Standard error is based on individual differences.

3. Method: sample in people (Subjects)

sample in objects ("Gent")

4. Singular conditions: e.g., San Diego

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25X1 IV.  Interests

1. % of probability of detecting new target or complex as a function of resolution: By COMOR Target Category.
2. Identification
3. Mean Distribution in size, orientation and location of targets--  
A requirements problem?

**SECRET**NPIC/P&DS-3/65  
6 January 1965

## DEFINITION OF P.I. PERFORMANCE STUDY # 2

In attempting to define the next short-term, accelerated study which is to be performed by [ ] under the existing contract on P. I. performance studies, P&DS and DD/S&T jointly derived some parameters which specifically apply to the method of investigation used in the preliminary study of "Performance as a Function of Resolution." The objective of the next study is to determine optimum stereo convergence and related obliquity angles for P.I.'s performing a representative image recognition task.

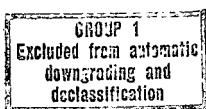
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It has recently been decided by the P&DS, who is funding the studies, that -- on the basis of the results of the first study in combination with the March deadline set for the subsequent study -- a less encumbered, more manageable approach should be used for the current problem. The first study has merit in its own right, but its shortcomings indicate that it needed the benefit of more time, and constant, clear, and unharried prosecution.

Moreover, we are indebted to make the best and most economical use of the P.I. time which has so generously been offered for our testing programs.

At a meeting on 9 January, which is to be attended by DD/S&T and P&DS contingents, the contractors will be asked to suggest a course which they feel they can manage in the time allotted.

The parameters which were originally set for the second study are still somewhat applicable and are included here for reference and to prompt additional thoughts for the 9 January discussions. All comments relate specifically to the experimental design of study #1.

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I We are again interested in approximating that kind of task which requires identification of specific features within a target-type. As before, half of the participants will be selected from DIA and half from CIA components. The sample should be moderate in size so as not to misuse existing cooperation of the operational photo interpreters. These people should represent the best level of effort and specialization NPIC is capable of providing for a given target-type. Consequently, the selection of participants should this time be more thoroughly worked out in advance of the testing. In addition, non-P.I.s should be considered for participants for the sake of an interesting gauge on the tests.

II It is recommended that photography be collected over the southwest U. S., over a populous area containing approximately four target-types of interest for testing. The final decision on the area and the flight paths should be made by the contractors since, by this decision, they will be designating the subject matter for the test questions. We express confidence in the contractor's knowledge of the variables and their intimacy with the in-house operations and therefore expect them to assume the responsibility for those details and decisions which affect experimental design of the test.

Houston, Texas, (or Texas City-Galveston) is suggested as an area containing a variety of targets-of-interest.

1. Industrial -- refineries, chemical plants, steel mill, rubber plant, POL terminal, oil fields.
2. Transportation -- numerous highway and train bridges of various capacities; railroad, marshalling, and freight yards; commercial airports; shipping and ship channel; port facilities.
3. Military -- Ellington AFB, SAGE Combat and Direction Center, POL storage, NASA Space Center.
4. Power Plants and dam.

III The degraded materials should simulate a satellite photographic system having the following characteristics:

1. altitude -- 80 miles
2. focal length -- 60"
3. ground resolution --
4. contrast -- 2:1

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IV For all intents and purposes sun altitude and azimuth angles should remain constant. Sun altitude should provide minor shadow effect but should not create "dead" shadows which obscure large areas. (An angle which falls in the range of  $60^{\circ}$  to  $80^{\circ}$  would be suitable.)

V Because of obvious time limitations, an upper and lower limit is to be set on the range of possible stereo convergence angles which could be tested. The upper limit of useable stereo is believed to have been determined and to be physiologically limited to some convergence angle near  $30^{\circ}$ . This limit can be further specified and corroborated by means of a literature search which [ ] will be requested to perform.

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Mensuration capabilities will set the lower limit beyond which accuracy of measurement falls off rapidly. A consultant to NPIC was requested to determine this lower limit(s) -- particularly for obliquity angles between  $30^{\circ}$  and  $60^{\circ}$ . His work indicates that for measuring stereo heights a critical drop-off in precision occurs below  $20^{\circ}$  of stereo convergence angle (for all obliquities) and at  $15^{\circ}$  that drop-off becomes severe. It would appear that convergences below  $20^{\circ}$  are just not in the running. Graphwork also indicates that as angle of convergence increases, accuracy increases until it becomes asymptotic at  $30^{\circ}$ . The smaller the angle of obliquity, the greater the accuracy, though the difference for convergences between  $20^{\circ}$  and  $30^{\circ}$  is in terms of 6" to 10" of measuring precision.

Three convergence angles equally divided between the upper and lower limits of the assigned stereo range are designated:  $10^{\circ}$  -  $20^{\circ}$  -  $30^{\circ}$ . These angles are to be examined in terms of: 1.) their effect alone upon P.I. performance, and 2.) their effect in combination with the below specified obliquities upon P.I. performance.

VI Obliquities are a "bonus" effect and will always be desired for the added information they can provide for many kinds of targets. Since their effect on optimum stereo convergence angle for interpretation purposes has not yet been established, the study should include three obliquity angles for each stereo convergence which is to be examined. The study should take into consideration obliquity angles within the range recognized by P.I.s as yielding the most valuable "extra" intelligence: i.e., angles of  $30^{\circ}$ ,  $45^{\circ}$  and  $60^{\circ}$ . Using these values as a basis, we hope to set a maximum scan angle which could be suggested for new systems.

Obliquity will also be investigated as an individual factor and in light of its effect upon the selected convergence angles and resulting P.I. performance.

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VII This paper suggests a general approach to the testing which is, of course, subject to revision by the contractors designing the experiment.

It is felt that a closer approximation of the actual conditions under which a PI performs (and is motivated) can be attained by submitting the selected GEMS and accompanying questions into the requirements system as regular PI assignments. These tasks should be limited to specific questions derived with the help of the requirements people and similar to those used in Task I, test #2. Through close cooperation of [redacted] it would be possible to present these tasks to the PI's, through their Branch Chiefs, as domestic coverage whose quality of readout has importance for the evaluation of new systems. Perhaps there could be four separate tasks -- one for each selected target type (or site) -- and each task could be assigned to three or four different people, working individually or in pairs, who are considered the best for their assigned target-type. This selection could also include individuals who are considered well-qualified, experienced PI's but who have a more general orientation. We need to consider the effects of stereo convergence and related obliquity angle in light of the optimum readout which NPIC can produce for a given resolution. Thus, we are primarily interested in refined intelligence not immediate readout.

Search situations would not be part of the problem, since, with current equipment, stereo is infrequently used for scanning.

The participating PI's could be instructed to use only the collateral information provided (them) with the questions -- for the reason that the amount and kind of collateral would be similar to what is available on a comparative USSR target. With four relevant target-types, each of which would be considered only in part, we would have a chance to select domestic targets which: 1) because they are dissimilar to equivalent Soviet Bloc targets, could be treated as totally "new" targets which have just been detected (i.e., missile-associated activities); or 2) because they are similar in recognition characteristics and basic features to Soviet targets, could be treated as existing targets.

[redacted]  
Assistant for Plans and Development

**SECRET**

MEETING DEC. 1964  
To REVIEW FINAL REPORT  
of STUDY I

DISCUSSIONS ON EXPERIMENTAL PI TESTS

Those Present:



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25X1 [redacted] began the meeting with a discussion of the next task in the performance studies. He stated that we intend to continue this work on a long term basis as described earlier by [redacted]

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25X1 1. [redacted] asked what resolution did you get down to?  
25X1 [redacted] stated that we may later use the  
25X1 RA 5C Camera system which will give the fine resolutions DIA is interested in.

25X1 [redacted] You do expect in the future to get down to battlefield resolution?

25X1 [redacted] Yes. [redacted] then stated that by 1970 the DOD wants  
25X1 to have [redacted] resolution -- this is what is desired but of course may not be possible. [redacted] stated that in the next phase we hope to examine the effect of scan angles, as well as effects of stereo convergence angle.

25X1 [redacted] What was the purpose of this preliminary experiment?

25X1 [redacted] It was based around considerations such as: where are the break-points between the photography and ground resolution.

25X1 [redacted] In the study you didn't vary the ground resolution.

25X1 [redacted] Yes, the ground resolution was varied; there were four different ground resolutions used.

25X1 [redacted] When we were asked to make up the requirements for up to 1970, we were to determine what the intelligence requirements will be for making ground measurements. We came up with an arbitrary list of measurements that would be desirable, particularly Mach I low-level. Now we would like to prove that these things can be done. One of the reasons we are asking such things is that [redacted] wants to know what is the caliber of the type of rifle being used in Viet Nam. We realize that more R&D work is needed.

25X1 [ ] We have to get a feel for what is required in determining what the general family of camera configurations should be.

25X1 [ ] Make a measurement down to [ ]

25X1 [ ] by any method -- to meet this size.

25X1 [ ] Are these mensuration requirements?

25X1 [ ] Yes, we need 90 per cent accuracy.

25X1 [ ] Is photography the proper source for this information?

25X1 [ ] Presently, photography seems to be the best possible way.

25X1 [ ] Is it worth the cost of getting it to [ ]

25X1 [ ] Cost-effect analysis is why DD/S&T is involved.

25X1 [ ] Certain identification can be made [ ] really what you want to solve the problem. You don't know until you get to that point.

25X1 [ ] These figures are not mensuration accuracy.

25X1 [ ] No, but this can be done in general -- relative to identification. [ ] stated that the PI's tested couldn't tell even [ ] what type of plane was to be identified.

25X1 [ ] If PI's were used that were trained in identifying aircraft, I think, the results would be better.

25X1 [ ] This was taken into account, and we are going to give this same test to the Navy people in Suitland to see how they do.

25X1 [ ] It appears from work done that reasonable answers can be obtained in this fashion. The problem is first to determine what is important and, secondly, what is the relative worth of doing work like this, with all its limitations on either a long-term or short-term basis.

25X1 [ ] What is the conclusion of this? What is the effect of ground resolution on PI performance?

25X1 [ ] That can only be answered with the consideration of the limitations of time, etc.

[ ] I would like to understand these graphs.

25X1 [ ] As all of the graphs are similar, let's take this one.

25X1 [ ] Distribution or proportions are as many groups to 90 per cent some 30 per cent, mean to median is quite different.

25X1 [ ] When you plot this distribution what is it?

25X1 [ ] The frequency disposition or proportions of responses at each data point, where each aircraft has the same weight.

25X1 [ ] What factors do you think will affect answers?

[ ] Most of the PI's were not familiar with these types of aircraft.

[ ] After you do a number, you would look at it and say it is this or that without analyzing.

25X1 [ ] The subjects were asked to analyse each one independently.

25X1 [ ] What is the required resolution size to do technical intelligence?

25X1 [ ] It wasn't a question of resolution. We asked them to tell us what this aircraft is.

25X1 [ ] To identify and to analyze is different.

25X1 [ ] The amount of difference in the tails of the aircraft figure into the difficulty of determining what they are.

[ ] Is this a combination plot or an absolute plot? How many chances did the PI have of being wrong?

[ ] There were 16 individual ones and 3 groups.

25X1 [ ] Ideally you would make up some plan views -- this was not an ideal experiment.

25X1 [ ] How did they determine the difference between prop and jet?

25X1 [ ] We asked them to take a risk if they were not sure and, if they absolutely did not know, to indicate that.

[ ] Did you ask questions where there were no aircraft?

25X1 [ ] Yes, we included a few blanks.

5X1

[REDACTED]

How did you tell in the fighter aircraft if they were prop or jet? It seems that these were not identified by the engine and there are straight-winged jets. There is some danger in using this data because you could draw some wrong conclusions.

5X1

[REDACTED]

You have to consider how the PI responds. The results could have been lower than the 50 per cent. This is an area of risk-taking. In this case they were roped together.

As the resolution gets smaller, how willing is the PI to take the risk to try to identify the object?

5X1

[REDACTED]

You almost have to say look at these pictures and tell us when (at what resolution) you are prepared to make an estimate.

You can't ignore that this is done in the way people do their every day work.

5X1

[REDACTED]

Would they look at the smallest size first and then go back?

In this test we asked them to look at each one individually.

5X1

[REDACTED]

N different pictures at N different resolutions. Why didn't you do that this time? [REDACTED]

25X

25X1

[REDACTED]

We did not have enough scenes. [REDACTED]  
PI's per scene, per resolutions.

25X

There is a memory factor when seeing a particular thing at various resolutions.

25X1

[REDACTED]

Perhaps after these studies we will find that we need to alter in the way people do their day-to-day work.

25X1

[REDACTED]

It would be very good to put each individual response on IBM cards.

I don't think it's a good idea on this test -- with such small amounts of data. On a larger test it would be more reliable and putting the information on IBM cards would be worthwhile.

25X1

[REDACTED]

The tests include more than aircraft. How many PI hours were used?

About 10 hours per man.

25X1

[REDACTED]

To be investigated next are ground resolutions with ships and then military installations as the target-types.